

ALLERGEN NEUTRALIZATION COMPOSITIONS CONTAINING ALUMINUM IONS

Akikazu (NMN) Yoshikawa

5

Ranjit (NMN) Chatterjee

Ryoko (NMN) Kobayashi

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of International Application Serial No.

10 PCT/US01/04070 filed February 8, 2001, published in English under PCT article 21(2).

TECHNICAL FIELD

The present invention relates to aqueous allergen neutralizing compositions comprising solubilized aluminum ions, and methods of using these compositions. The present compositions are particularly effective against the allergens associated with house dust mites and other common allergens such as cat dander, pollen and the like.

15

BACKGROUND OF THE INVENTION

Sensitivity to allergens is a problem for an increasing number of consumers. This issue has been complicated by a surprising increase in asthma over the past few years. Asthma suffers are especially sensitive to airborne allergens. Allergy rates are also on the rise. This gives rise to increased awareness of the causes of allergy symptoms and how to decrease the associated discomfort.

20

Allergic reactions can be initiated in many ways, but one of the most common ways is by the inhalation of airborne allergens. Another common way to ingest allergens is when they come in direct contact with a moist surface on the body where they stick and react with the surrounding body tissue. This can happen, for example, when a person lays down in bed and allergen containing dust that lay on the pillow or bed coverings contacts and is absorbed into the person's eyes. This typically results in an allergic reaction as the allergens are gradually absorbed into the mucous around the eye.

25

30

Many allergens are protein based molecules, and these protein allergens can originate from many sources. It has been know for some time that one of the most

2007-06-20 06:57:20

common sources of allergens in a house is from dust mites. Of course, as is the case with all allergens, only certain people are allergic to dust mite allergens. But this group of people can be quite large in many areas, especially in hot humid areas. For example, in the south eastern United States of America, where it is both hot and humid for much of the year, the incidence of house dust mite allergies in the general population can be as high as 25%.

House dust mites thrive in plush carpets, overstuffed upholstery, cushy bed comforters and the like. Medical professionals who specialize in the treatment of allergies often recommend the removal of these items from the homes of people who suffer from dust mite allergies. For many reasons, this is often an impractical and unworkable solution to the problem of dust mite allergies.

Another common method for removing mite allergens from a house is the use of miteicides to kill the mites. But, unfortunately, the proteins that cause allergic reactions can be found in the mite corpses and also the residual mite feces. Thus, killing the mites does not solve the problem. And because some miticides can be relatively harsh chemicals, it might not be advisable to use these chemicals throughout your home on a regular basis.

Other methods for neutralizing allergens in the home include spraying household surfaces with compositions that either denature the allergens or simply cover them. The denaturing sprays, in theory, render the protein molecules inactive with respect to causing an allergic reaction. This is accomplished by chemical complexing between the allergen protein and the denaturing chemical such that the allergen can no longer initiate an allergic reaction in a human. For various reasons, this approach has not proven entirely satisfactory for allergen sufferers.

Specifically, currently available allergen neutralization sprays typically use a tannin, or other related polyphenols, as the active component. But tannins and related chemicals are notorious for their strong yellow color. Thus, these chemicals cannot be sprayed onto fabrics without a substantial risk of staining the fabric material. As discussed above, fabrics such as bed covers, furniture covers, floor coverings, draperies, etc. are typically the areas where allergens can be found. Thus, few consumers feel comfortable spraying allergen neutralization compounds on their household fabrics.

For these reasons there exists a need for products that can neutralize allergens or at least keep them out of the air. These products should be sprayable and compatible with a wide variety of fabric materials. That is, the spray products should not stain or otherwise damage common household fabrics that are used in making draperies, bed covers, carpeting, rugs, clothing, furniture covers and others. Moreover, these materials should create no additional health or environmental problems. For example, the spray products should not have a noxious smell nor should they be toxic to humans and household pets.

Importantly, and in addition to the needs discussed above, there exists a need for allergen neutralization products that have improved denaturing efficacy as compared to currently existing spray products. That is, the spray should denature a greater amount of proteins and a greater variety of proteins than currently available sprays. These and other needs are met by the allergen neutralization spray products of the present invention.

SUMMARY OF THE INVENTION

In one aspect, the present invention comprises an allergen neutralization composition for use on inanimate objects. This composition comprises an effective amount of an allergy neutralizing aluminum ion, and a solvent. The allergen neutralization compositions of the present invention are sprayable, and at least about 60%, preferably at least about 70%, more preferably at least about 80%, and most preferably at least about 90%, by weight of the aluminum ion is provided as a salt of an anion selected from the group consisting of sulfate, chloride, nitrite, potassium sulfate and mixtures thereof. The aluminum ion, that is Al^{3+} , can be present in the composition at about 0.001% to about 10%, preferably from about 0.01% to about 5.0%, more preferably from about 0.05% to about 1.0%, by weight, of the allergen neutralization composition. In one aspect of the present invention the allergen neutralization composition comprises essentially no aluminum chlorohydrate. By "essentially free of" it is meant the allergen neutralization composition contains less than about 0.5%, preferably less than about 0.1%, and even more preferably less than 0.01%, by weight, of aluminum chlorohydrate. Preferably, less than 10%, more preferably less than 5%, even more preferably less than 1%, by weight of the aluminum ion is provided as aluminum chlorohydrate.

Preferably, the allergen neutralization compositions further comprise a wetting agent, and additional allergen denaturing compounds selected from the group consisting of polyphenol compounds, hydrogen peroxide, salicylic acid, citric acid, lactic acid, glycolic acid, ascorbic acid, gallic acid, gluconic acids, additional metal ions and mixtures thereof. Other optional ingredients include film forming polymers to control the allergen containing dust.

In another aspect of the present invention, the allergen neutralization compositions further contain additional metal ions selected from the group consisting of ions of zinc, stannous, stannic, magnesium, calcium, manganese, titanium, copper, nickel, and mixtures thereof.

The solvent for the allergen neutralization compositions of the present invention preferably comprises water, and more preferably the solvent comprises from about 0.01% to about 20%, by weight of the allergen neutralization composition, of a volatile lower alcohol.

The allergen neutralization compositions of the present invention provide superior performance in reducing consumers allergy symptoms. These compositions operate on the principle of neutralizing the proteins associated with common house dust mites. Unfortunately, these proteins are not just associated with the live mites, but can be found in the feces and corpses of the house dust mites. The primary function of these allergen neutralization compositions is not to kill the house dust mites, but rather to neutralize the allergen proteins. The proteins can be neutralized chemically by denaturing, or they can be physically disabled by dust control methods. In either event, the proteins that cause allergic reactions in humans are neutralized or kept from entering the human body, as opposed to simply killing the mites.

The compositions of the present invention, in addition to providing improved efficacy, are compatible with a wide variety of household surfaces where house dust mites, and their feces and corpses might reside. This provides a substantial benefit because many known allergen neutralization compositions are known to discolor fabrics and hard surfaces. As can be appreciated, a product that is effective against allergen containing compounds will not be received favorably by consumers if it discolors or destroys the household surfaces on which it is used. Thus, the present compositions

provide many unexpected and superior benefits over known allergen neutralizing compositions.

DETAILED DESCRIPTION OF THE INVENTION

5 As used herein, the phrase "allergen neutralization" is intended to include both chemical denaturing and physical covering of the allergen containing protein. The compositions of this invention may neutralize allergens by chemically denaturing them, physically covering them, or both. More specifically, by chemical denaturing, it is meant that the chemical structure of an allergen containing protein is altered such that it no longer gives rise to allergic reactions in humans. While not wanting to be bound by any one theory, it is believed that the aluminum ions of the present compositions, and the optional additional allergen denaturing compounds, bind with the protein molecule in a way that prevents further generation of a human's histamine. This is only one example of many potential chemical denaturing mechanisms. Ultimately, the allergic reaction is not initiated.

15 Likewise, physical "covering" of the allergen protein, or the particles such as dust, that contain these proteins, inhibit the initiation of the allergic reaction. While again, not wanting to be bound by any one theory, it is believed that an allergen protein must be solubilized or dispersed by the human body to initiate an allergic reaction. This can occur when the protein contacts body fluids such as sweat on the skin, mucous in the eyes and nasal cavities, or saliva in the mouth. It is believed that if the protein is covered in a composition that does not readily solubilize or disperse in bodily fluids, the protein will not be available to initiate the allergic reaction. Moreover, physically covering a protein or the particles that contain the protein, for example, a house dust mite, the corpse of a house dust mite, or a common dust particle, the particles may be too heavy to become airborne. Because many allergens are inhaled, the simple act of "grounding" the allergen containing particles can significantly decrease the symptoms experienced by an allergy sufferer.

I. ALLERGEN NEUTRALIZATION COMPOSITIONS

ALLERGEN NEUTRALIZING ALUMINUM IONS

208530" 65T 200F

An essential component of the present invention is an allergen neutralizing aluminum ion, that is preferably supplied as a metallic salt. As discussed above, it is believed that these aluminum ions provide an allergen protein denaturing benefit. At least about 60%, preferably at least about 70%, more preferably at least about 80%, and most preferably at least about 90%, by weight of the aluminum ion is provided as a salt of an anion selected from the group consisting of sulfate, chloride, nitrite, potassium sulfate and mixtures thereof. The aluminum ion, that is the Al^{3+} , can be present in the composition at a concentration of from about 0.001% to about 10%, preferably from about 0.01% to about 5.0%, more preferably from about 0.05% to about 1.0%, by weight, of the allergen neutralization composition. In one aspect of the present invention the allergen neutralization composition comprises essentially no aluminum chlorohydrate. Preferably, less than 10%, preferably less than 5%, more preferably less than 1%, by weight of the aluminum ion is provided as aluminum chlorohydrate.

Aluminum ions function as excellent allergen neutralization compounds, but it has surprisingly been determined that the efficacy of the aluminum ion is effected by the form in which it is added to the compositions of this invention. Specifically, when the aluminum ion is supplied as a salt of sulfate, chloride, nitrite, potassium sulfate and mixtures thereof, the efficacy of the aluminum ion is substantially improved over the efficacy when the aluminum is supplied as a salt of aluminum chlorohydrate. These results are unexpected and surprising to those skilled in the art and the data supporting this finding are shown in Example I below.

ADDITIONAL ALLERGEN DENATURING COMPOUNDS

While the aluminum ions discussed above perform an allergen denaturing function, additional allergen denaturing compounds may optionally be incorporated in the present compositions. These allergen denaturing compounds are preferably selected from the group consisting of polyphenol compounds, hydrogen peroxide, salicylic acid, citric acid, lactic acid, glycolic acid, ascorbic acid, gallic acid, gluconic acids, additional metal ions and mixtures thereof. Other alkyl acids are appropriate for use herein. When additional allergen denaturing compounds are incorporated into the compositions of this invention, it is preferred that low molecular weight alcohols, for example, ethanol,

methanol, propanol or isopropanol, are used in the solvent. The solvent is discussed in greater detail below, but the use of low molecular weight alcohols in this context is to ensure solubility and stability of the allergen denaturing compounds in the composition. Low molecular weight alcohols are especially preferred when the concentration of the allergen denaturing compound exceeds 10% by weight of the allergen neutralization composition.

The polyphenol compounds include tannins, catechins, gallic acid and the like. These include either a natural or a synthetic substance such as, but not limited to, tannic acid or a synthetic tanning agent. Synthetic tannins/tannic acids generally fall into three chemical groups: 1) the so called auxiliary tans which are generally strong simple organic acids; 2) combination tans which are general sulphonic acids of complex phenolic materials; and, 3) exchange or replacement tans which are weakly acidic polymeric derivatives containing a large number of phenolic groups. Suitable tanning agents may be selected from cresol sulphonic acid ammonium salt (Neosyn RW), melamine formaldehyde sulphonate (Parnel A), a poly phenolic formaldehyde sulphonate (Suparex L) or a multiphenol formaldehyde sulphonate (Basyntan WL) as sold commercially for leather tanning or treatment. Other similar synthetic materials capable of reaction with protein (tanning action) may also prove effective when appropriately formulated. More recently formaldehyde reaction products of condensates and polymers of urea and melamine and mixtures thereof have been introduced for the manufacture of specialized leathers. These are also acceptable allergen denaturing compounds for the purpose of the present invention.

Naturally derived tannic acids and polyphenolics are also desirable for the present invention. The ones that do not develop color rapidly with air are most preferred. A most preferred tannin source is the kaki extract supplied as Pancil by Ririsu Scientific Industry of Osaka, Japan. This tannin is described in Japan Patent Application No 1991-3-61457; the entire disclosure of this Japan Patent Application is incorporated herein by reference.

The additional metal ions are preferably provided as metallic salts selected from the group consisting of zinc, stannous, stannic, magnesium, calcium, manganese, titanium, manganese, copper, nickel, and mixtures thereof. Stannic, also known as tin^{4+} , is less preferred than stannous due primarily to solubility problems with stannic at low

pH. But those skilled in the art will be able to formulate suitable compositions with either substance.

The preferred additional metal ions are zinc and stannous as these generally show high efficacy, with few detrimental environmental issues. Highly-ionized and soluble metal salts such as zinc chloride, provide the best source of additional metal ions. While certain cations yield superior solubility, all cations are acceptable for the additional metal salts of the present invention. For example, all halides, sulfates, ammonium, etc. Preferably the additional metal ions are provided as metallic salts that are water-soluble zinc salts, stannous salts or mixtures thereof, and especially ZnCl_2 and SnCl_2 .

When present, the additional allergen denaturing compositions are typically present at a level of from about 0.01% to about 20%, preferably from about 0.1% to about 10%, more preferably from about 0.2% to about 8% by weight of the usage composition.

DUST CONTROL

One method of relieving allergy symptoms is to control "dust" particles that may contain allergenic protein molecules. "Dust" as used herein refers to any particulate matter that might be found in an enclosed space that might be occupied by one or more humans. The particulate matter can be as small as one or more allergenic protein molecules or it can comprise larger particles, for example, dust mites, their fecal matter and their corpses. Houses and the rooms within a house, cars, hotel rooms, train cars, airline cabins, are among the many places that allergen containing dust might be found. By immobilizing a portion of the dust, the allergenic proteins are unavailable to cause allergic reactions in humans. By this method, dust control can reduce allergic reactions in humans.

To control dust, the allergen neutralization compositions of this invention are sprayed onto common household surfaces where allergen containing dust might be found. A portion of the dust is then immobilized, but a portion of the allergenic proteins will be neutralized as well. The dust particles are generally immobilized by film forming polymers that preferably do not leave a sticky film on fabrics. The ability for a composition to control dust can be measured and quantified by the "Dust Control Test" given in commonly assigned PCT Patent Application Nos. PCT/US00/27018 and

PCT/US00/27019, both are entitled "Allergen Neutralization Compositions", filed on September 29, 2000, by Hasan et al. The entire Disclosure of the Hasan et al. applications are incorporated herein by reference.

Film forming polymers suitable for use in the present invention include, water-soluble polymers selected from the group consisting of starch, polyvinyl alcohols, methyl cellulose and its derivatives, preferably, carboxy methyl cellulose ("CMC") and its derivatives, polyacrylic acids, polyethylene glycols with molecular weight higher than 5000, polyethylene, polypropylene glycol with molecular weight higher than 8000, Cosmetic Toiletry Fragrances Association ("CTFA") polyquaternium compounds 1 through 14, polyvinyl pyrrolidone ("PVP") and its derivatives, and mixtures thereof. Specific examples of certain preferred film forming polymers are selected from the group consisting of hydroxy-propyl starch, Daisel CMC 1310, Kuraray poly vinyl alcohol ("PVA") 205, N-Polyvinyl-2- pyrrolidone, and mixtures thereof.

The film forming polymers are present in the composition at about 0.001% to about 20%, preferably from about 0.01% to about 10%, more preferably from about 0.05% to about 1.0%, by weight, of the allergen neutralization composition.

SOLVENT

The solvent for the allergen neutralization compositions of the present invention preferably comprises water, and more preferably the solvent comprises a volatile lower alcohol. The water that is used can be distilled, deionized, or tap water. Water not only serves as the liquid carrier for the aluminum ions and other ingredients, it also facilitates the complexation reaction between the aluminum ion, the optional allergen denaturing compositions and the allergenic protein. Not to be bound by theory, it is believed that water solubilizes the allergenic protein allowing it to react with the aluminum ions, allergen denaturing compounds or both.

Low molecular weight alcohols with relatively low boiling points, as compared to water, such as methanol, ethanol, propanol and butanol, are preferred optional ingredients for improving the drying speed of the present compositions. Specifically, when the aqueous based compositions of this invention are sprayed on a solid surface, the surface necessarily becomes wet. Consumers, in general, do not like having wet counter tops,

furniture, bedding and other common surfaces. Thus, for consumer acceptance, it is preferred that the compositions herein dry quickly after being applied to a surface. The addition of a low molecular weight alcohol substantially improves the drying time of the present compositions.

5 Typically, alcohol is added to the composition of the present invention at a level of from about 0.01% to about 20%, by weight of the composition, preferably from about 0.05% to about 10%, more preferably from about 0.1% to about 5.0%, by weight of the composition. It is understood that specialty products, for example, concentrated or refill solutions, solutions for industrial use, and the like, may contain higher levels of alcohol.
10 In these products the alcohol can be present at levels of from greater than 20% to about 70%.

The solvent is preferably present in the allergen neutralization composition at a concentration of from 1% to about 99%, preferably from about 3% to about 95%, and more preferably from about 5% to about 90%, by weight of the composition.

15 **WETTING AGENT**

It is preferred that the compositions of the present invention include a wetting agent such as a surfactant or the like. Most preferably, the wetting agent is fully compatible with the aluminum ions and the optional additional allergen denaturing
20 compounds and other optional ingredients. The compatible wetting agent reduces surface tension of the composition of the present invention such that when the composition is sprayed on a surface the composition spreads evenly over the surface and wets the surface better. This allows the maximum amount of the active ingredients to contact the surface where the allergens may be present.

25 Preferred wetting agents for use in the present allergen neutralization compositions have an HLB of greater than about 8, and do not foam excessively. Excessive foaming can be determined by placing 300 ppm of the wetting agent in 100ml of distilled water in a 1000 ml stoppered graduated cylinder. The cylinder is shaken by inverting it 50 times. The cylinder should then be left to settle for 5 minutes. The
30 resulting foam height after the settling period should be less than 50 ml. Non-limiting examples of wetting agents suitable for use herein include fatty alcohol ethoxylates, fatty

alcohol ethoxylate-propoxylate, sulfates of alcohols or ethoxylated fatty alcohols, sorbitan monoesters, amine oxides, ethoxylated fatty acid esters, alkyl ether phosphates, alkyl polyglycosides, fatty acid glucosamides, alkyl phenol ethoxylates, alkyl phenol ethoxylated sulfates, paraffin sulfonates, fatty alcohols sulfates, alkyl phenyl sulfonates, linear alkyl benzene sulfonates, alkyl dimethyl betaines, alkyl dimethyl hydroxy propyl sultaines, alkoxyolated polydimethyl siloxanes, alkyl dimethyl amine oxides having alkyl chains with 6-18 carbons, and mixtures thereof. In addition to the foregoing list, many other surfactant compounds selected from the group of anionic, nonionic, cationic, zwitterionic and mixtures thereof are suitable wetting agents for use herein. One preferred cationic surfactant suitable for use as a wetting agent in the present invention is Coco K3, which is a mono dodecanoate or tetradecanoate ester of methyl triethanol ammonium chloride.

Typical levels of wetting agents for use in the present compositions are from about 0.01% to about 3%, preferably from about 0.03% to about 2%, more preferably from about 0.05% to about 1.0%, by weight of the composition.

Nonlimiting examples of compatible nonionic surfactants include block copolymers of ethylene oxide and propylene oxide. Suitable block polyoxyethylene-polyoxypropylene polymeric surfactants, include those based on ethylene glycol, propylene glycol, glycerol, trimethylolpropane and ethylenediamine as the initial reactive hydrogen compound. Polymeric compounds made from a sequential ethoxylation and propoxylation of initial compounds with a single reactive hydrogen atom, such as C₁₂₋₁₈ aliphatic alcohols, are not generally compatible with the cyclodextrin. Certain of the block polymer surfactant compounds designated Pluronic® and Tetronic® by the BASF-Wyandotte Corp., Wyandotte, Michigan, are readily available. Examples of Pluronic® and Tetronic® surfactants are given below.

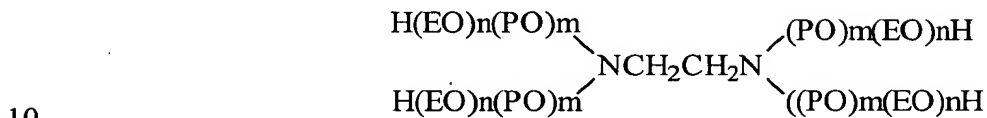
Nonlimiting examples of Pluronic Surfactants with the general formula H(EO)_n(PO)_m(EO)_nH, wherein EO is an ethylene oxide group, PO is a propylene oxide group, and n and m are numbers that indicate the average number of the groups in the surfactants. Typical examples of cyclodextrin-compatible Pluronic surfactants are:

Name	Average MW	Average n	Average m
------	------------	-----------	-----------

	L-101	3,800	4	59
	L-81	2,750	3	42
	L-44	2,200	10	23
	L-43	1,850	6	22
5	F-38	4,700	43	16
	P-84	4,200	19	43,

and mixtures thereof.

Tetronic Surfactants have the general formula:



wherein EO, PO, n, and m have the same meanings as above. Typical examples of Tetronic surfactants are:

15

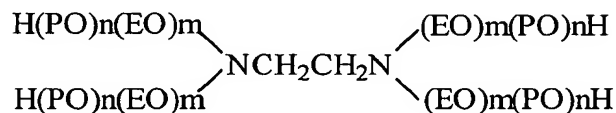
Name	Average MW	Average n	Average m
901	4,700	3	18
908	25,000	114	22,

and mixtures thereof.

"Reverse" Pluronic and Tetronic surfactants have the following general formulas:

Reverse Pluronic Surfactants $\text{H(PO)}_m\text{(EO)}_n\text{(PO)}_m\text{H}$

20 Reverse Tetronic Surfactants



25 wherein EO, PO, n, and m have the same meanings as above. Typical examples of cyclodextrin-compatible Reverse Pluronic and Reverse Tetronic surfactants are:

Reverse Pluronic surfactants:

Name	Average MW	Average n	Average m
------	------------	-----------	-----------

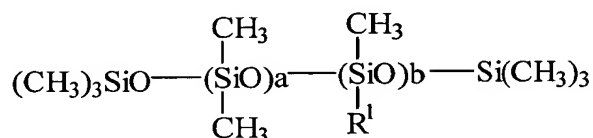
10 R5	1,950	8	22
25 R1	2,700	21	6

Reverse Tetronic surfactants

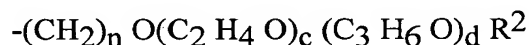
Name	Average MW	Average n	Average m
5 130 R2	7,740	9	26
70 R2	3,870	4	13

and mixtures thereof.

- Another class of suitable nonionic wetting agents includes polyalkyleneoxide polysiloxanes having a dimethyl polysiloxane hydrophobic moiety and one or more hydrophilic polyalkylene side chains. Examples of this type of surfactants are the Silwet® surfactants which are available OSi Specialties, Inc., Danbury, Connecticut, and have the general formula:



- wherein a + b are from about 1 to about 50, preferably from about 3 to about 30, more preferably from about 10 to about 25, and R¹ is mainly one or more random poly(ethyleneoxide/propyleneoxide) copolymer groups having the general formula:



- wherein n is 3 or 4, preferably 3; total c (for all polyalkyleneoxy side groups) has a value of from 1 to about 100, preferably from about 6 to about 100; total d is from 0 to about 14, preferably from 0 to about 3; and more preferably d is 0; total c+d has a value of from about 5 to about 150, preferably from about 9 to about 100 and each R² is the same or different and is selected from the group consisting of hydrogen, an alkyl having 1 to 4 carbon atoms, and an acetyl group, preferably hydrogen and methyl group.

Representative Silwet surfactants are as follows.

Name	Average MW	Average a+b	Average total c
25 L-7608	600	1	9
L-7607	1,000	2	17
L-77	600	1	9
		13	

	L-7605	6,000	20	99
	L-7604	4,000	21	53
	L-7600	4,000	11	68
	L-7657	5,000	20	76
5	L-7602	3,000	20	29

The molecular weight of the polyalkyleneoxy group (R^1) is less than or equal to about 10,000. Preferably, the molecular weight of the polyalkyleneoxy group is less than or equal to about 8,000, and most preferably ranges from about 300 to about 5,000. Thus, the values of c and d can be those numbers which provide molecular weights within these

10 ranges. However, the number of ethyleneoxy units ($-C_2H_4O$) in the polyether chain (R^1) must be sufficient to render the polyalkyleneoxide polysiloxane water dispersible or water soluble. If propyleneoxy groups are present in the polyalkyleneoxy chain, they can be distributed randomly in the chain or exist as blocks. Preferred Silwet surfactants are L-7600, L-7602, L-7604, L-7605, L-7657, and mixtures thereof. Besides surface activity,

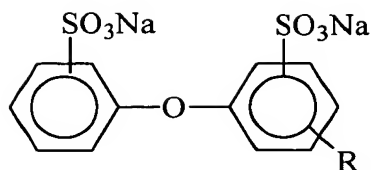
15 polyalkyleneoxide polysiloxane surfactants can also provide other benefits, such as antistatic benefits, lubricity and softness to fabrics.

The preparation of polyalkyleneoxide polysiloxanes is well known in the art. Polyalkyleneoxide polysiloxanes of the present invention can be prepared according to the procedure set forth in U.S. Pat. No. 3,299,112, incorporated herein by reference.

20 Typically, polyalkyleneoxide polysiloxanes of the surfactant blend of the present invention are readily prepared by an addition reaction between a hydrosiloxane (i.e., a siloxane containing silicon-bonded hydrogen) and an alkenyl ether (e.g., a vinyl, allyl, or methallyl ether) of an alkoxy or hydroxy end-blocked polyalkylene oxide). The reaction conditions employed in addition reactions of this type are well known in the art and in

25 general involve heating the reactants (e.g., at a temperature of from about 85° C. to 110° C.) in the presence of a platinum catalyst (e.g., chloroplatinic acid) and a solvent (e.g., toluene).

Nonlimiting examples of compatible anionic surfactants are the alkylidiphenyl oxide disulfonate, having the general formula:



wherein R is an alkyl group. Examples of this type of surfactants are available from the Dow Chemical Company under the trade name Dowfax[®] wherein R is a linear or branched C₆-C₁₆ alkyl group. An example of these cyclodextrin-compatible anionic surfactant is Dowfax 3B2 with R being approximately a linear C₁₀ group. These anionic surfactants are preferably not used when the composition contains a cationic material so as to minimize the interaction with the cationic actives, since the effect of both surfactant and active are diminished.

MITICIDES

Miticides can be optionally added to the compositions of the present invention to kill mites. As is discussed above, mites corpses are allergenic so killing the mites does not necessarily reduce the level of allergens. But dead mites cannot breed, so killing a portion of the mites can help to control the mite population.

Miticides acceptable for use in the present invention include compounds known under the common names as resmethrin, phenothrin, permethrin, allethrins, tetramethrin, furamethrin, cypermethrin, decamethrin, phenvalerate, phenpropathrin, terallethrin, empenethrin and pyrethrin. Additional miticides include pyrethroid compounds such as 1-ethynyl-2-methyl-2-pentenyl-2,2-dimethyl-3-(2,2-dichlorovinyl)-cyclopropane-1-carboxylate, 1-ethynyl-2-methynyl-2-pentenyl-2,2,3,3-tetramethylcyclopropane-1-carboxylate, α -cyano-3-phenoxybenzyl-2,2-dimethyl-3-(2,2,3-tribromomethyl)-cyclopropane-1-carboxylate; organic phosphorus compounds such as sumithion, fenthion, tetrachlorvinphos, diazinon and DDVP; and carbamate compounds such as those sold under the trademarks Baygon and Sevin.

A number of less toxic miticidal agents have been proposed for use in controlling dust mites. As noted in U.S. Patent No. 4,800,196, these include phenyl salicylate, diphenylamine, methyl β -naphthyl ketone, coumarin, phenethyl benzoate, benzyl

salicylate, phenyl benzoate, N-fluorodichloromethylthio-cyclohexene-dicarboxyimide, p-nitrobenzoic acid methyl ester, p-chlorometaxylenol, α -bromocinnamic aldehyde, 2,5-dichloro-4-bromophenol, N,N-dimethyl-N'-tryl-N'-(fluorodichloromethylthio)-sulfamide, 2-phenylphenol, sodium 2-phenylphenolate, 5-chloro-2-methyl-4-isothiazoline-3-one, 2-methyl-4-isothiazonoline-3-one and benzimidazolymethyl-carbamate and mixtures of these. One of the more effective agents for killing dust mites is benzyl benzoate, a compound which is readily available and inexpensive.

When one or more optional miticides are added to the composition of the present invention they are typically present at a level of from about 0.01% to about 20%, preferably from about 0.1% to about 10%, more preferably from about 0.2% to about 8% by weight of the usage composition.

COLOR STABILIZATION INGREDIENTS

The allergen neutralization compositions can optionally include ingredients to prevent color formation either in the product or on the fabrics and articles on which it is sprayed. As mentioned above, some of the additional allergen denaturing compounds, especially the preferred tannins, are known to discolor fabric materials. The optional color stabilization ingredients are intended to reduce or eliminate the discoloration problem. When used, the color stabilization ingredient will be present at a concentration of from about 0.1% to about 25%, preferably from about 0.5% to about 15% and more preferably from about 1% to about 10%, by weight of the allergen neutralization composition. Preferred chemicals include glycolic acid and its salts, lactic acid and its salts, gluconic acid and its salts, pyruvic acid and its salts, glucaric acid and its salts, ascorbic acid and its salts, hydroxy benzoic acids and the salts, aspartic acid and its salts, hydroxyglutamic acid and its salts, hydroxyphthalic acids and the salts, malic acid and its salts, and mixtures thereof.

Soluble detergent builders can also be included for color stabilization. Included among the soluble polycarboxylate builders are a variety of categories of useful materials. One important category of polycarboxylate builders encompasses the ether polycarboxylates, including oxydisuccinate, as disclosed in Berg, U.S. 3,128,287, U.S. 3,635,830. See also "TMS/TDS" builders of U.S. 4,663,071. Suitable ether

polycarboxylates also include cyclic compounds, particularly alicyclic compounds, such as those described in U.S. 3,923,679; 3,835,163; 4,158,635; 4,120,874 and 4,102,903.

Other useful builders include the ether hydroxypolycarboxylates, copolymers of maleic anhydride with ethylene or vinyl methyl ether, 1, 3, 5-trihydroxy benzene-2, 4, 6-trisulphonic acid, and carboxymethyloxysuccinic acid, the various salts of polyacetic acids such as ethylenediamine tetraacetic acid and nitrilotriacetic acid, as well as polycarboxylates such as mellitic acid, pyromellitic, succinic acid, oxydisuccinic acid, polymaleic acid, benzene 1,3,5-tricarboxylic acid, carboxymethyloxysuccinic acid, and soluble salts thereof.

Citrate builders, e.g., citric acid and soluble salts thereof (particularly sodium salt), are polycarboxylate builders of particular importance due to their availability from renewable resources and their biodegradability. Oxydisuccinates are also especially useful in such compositions and combinations. Other suitable polycarboxylates are disclosed in U.S. 4,144,226 and in U.S. 3,308,067. See also U.S. 3,723,322.

Also suitable in the compositions of the present invention are the 3,3-dicarboxy-4-oxa-1,6-hexanedioates and the related compounds disclosed in U.S. 4,566,984. Useful succinic acid builders include the C₅-C₂₀ alkyl and alkenyl succinic acids and salts thereof. A particularly preferred compound of this type is dodecenylsuccinic acid. Specific examples of succinate builders include: laurylsuccinate, myristylsuccinate, palmitylsuccinate, 2-dodecenylsuccinate (preferred), 2-pentadecenylsuccinate, and the like. Laurylsuccinates are the preferred builders of this group, and are described in EP 0,200,263.

Fatty acids, e.g., C₁₂-C₁₈ monocarboxylic acids such as oleic acid and/or its salts, can also be incorporated into the compositions alone, or in combination with the aforesaid builders, especially citrate and/or the succinate builders, to provide additional builder activity. Such use of fatty acids will generally result in a diminution of foaming, which should be taken into account by the formulator.

In situations where phosphorus-based builders can be used, the various alkali metal phosphates such as the well-known sodium tripolyphosphates, sodium pyrophosphate and sodium orthophosphate can be used. Phosphonate builders such as

ethane-1-hydroxy-1,1-diphosphonate and other known phosphonates (see, for example, U.S. Patents 3,159,581; 3,213,030; 3,422,021; 3,400,148 and 3,422,137) can also be used.

PERFUME

5 The allergen neutralization compositions of the present invention can also optionally include a perfume to provide a pleasing scent to the spray product. The perfume should not be designed to be overwhelming or to be used as an odor masking ingredient. Perfumes are typically added at low levels, e.g., from about 0% to about 0.5%, preferably from about 0.003% to about 0.3%, more preferably from about 0.005%
10 to about 0.2%, by weight of the usage composition.

 Perfume can also be added as a more intense odor in product and on surfaces. When stronger levels of perfume are preferred, relatively higher levels of perfume can be added. Any type of perfume can be incorporated into the composition of the present invention. Preferably the perfume is hydrophilic and is composed predominantly of
15 ingredients selected from two groups of ingredients, namely, (a) hydrophilic ingredients having a ClogP of less than about 3.5, more preferably less than about 3.0, and (b) ingredients having significant low detection threshold, and mixtures thereof. Typically, at least about 50%, preferably at least about 60%, more preferably at least about 70%, and most preferably at least about 80% by weight of the perfume is composed of perfume
20 ingredients of the above groups (a) and (b). Suitable perfume ingredients can be found in US Patent No. 5,670,475, which issued to Trinh et al. On September 23, 1997. The entire disclosure of the Trinh patent is incorporated herein by reference.

OTHER OPTIONAL INGREDIENTS

25 The compositions of the present invention can optionally contain ingredients including, solution phase stabilizers, chelating agents, antistatic agents, colorants, especially bluing agents, antioxidants, and mixtures thereof. The total level of optional ingredients is low, preferably less than about 8.0%, more preferably less than about 5.0%, and even more preferably less than about 3.0%, by weight of the usage composition.
30 Solution phase stabilizers include, alkali metal salts, for example, NaCl, CaCl₂, MgCl₂, KCl, KSO₄, and they are added to modify viscosity as well as to stabilize the solution.

These optional ingredients exclude the other ingredients specifically mentioned hereinbefore.

Colorant

Colorants and dyes, especially bluing agents, can be optionally added to the present compositions for visual appeal and performance impression. When colorants are used, they are used at extremely low levels to avoid fabric staining. Preferred colorants for use in the present compositions are highly water-soluble dyes, e.g., Liquitint® dyes available from Milliken Chemical Co. Non-limiting examples of suitable dyes are, Liquitint Blue HP®, Liquitint Blue 65®, Liquitint Patent Blue®, Liquitint Royal Blue®, Liquitint Experimental Yellow 8949-43®, Liquitint Green HMC®, Liquitint Yellow II®, and mixtures thereof, preferably Liquitint Blue HP®, Liquitint Blue 65®, Liquitint Patent Blue®, Liquitint Royal Blue®, Liquitint Experimental Yellow 8949-43®, and mixtures thereof.

Optional Preservative

Optionally, but preferably, solubilized, water-soluble, antimicrobial preservative can be added to the compositions. Because microbial growth in aqueous solutions is highly objectionable when it occurs, it is highly preferable to include a solubilized, water-soluble, antimicrobial preservative, which is effective for inhibiting or regulating microbial growth in order to increase storage stability of the preferably clear, aqueous allergen neutralization compositions of this invention.

It is preferable to use a broad spectrum preservative, e.g., one that is effective on both bacteria (both gram positive and gram negative) and fungi. A limited spectrum preservative, e.g., one that is only effective on a single group of microorganisms, e.g., fungi, can be used in combination with a broad spectrum preservative or other limited spectrum preservatives with complimentary and/or supplementary activity. A mixture of broad spectrum preservatives can also be used. In some cases where a specific group of microbial contaminants is problematic (such as Gram negatives), aminocarboxylate chelators may be used alone or as potentiators in conjunction with other preservatives. These chelators, which include, e.g., ethylenediaminetetraacetic acid (EDTA), hydroxyethylenediaminetriacetic acid, diethylenetriaminepentaacetic acid, and other aminocarboxylate chelators, and mixtures thereof, and their salts, and mixtures thereof,

can increase preservative effectiveness against Gram-negative bacteria, especially *Pseudomonas* species.

Antimicrobial preservatives useful in the present invention include biocidal compounds, i.e., substances that kill microorganisms, or biostatic compounds, i.e., substances that inhibit and/or regulate the growth of microorganisms.

Preferred antimicrobial preservatives are those that are water-soluble and are effective at low levels. Water-soluble preservatives useful in the present invention are those that have a solubility in water of at least about 0.3 g per 100 ml of water, i.e., greater than about 0.3% at room temperature, preferably greater than about 0.5% at room temperature.

The water-soluble antimicrobial preservative in the present invention is included at an effective amount. The term "effective amount" as herein defined means a level sufficient to prevent spoilage, or prevent growth of inadvertently added microorganisms, for a specific period of time. In other words, the preservative is not being used to kill microorganisms on the surface onto which the composition is deposited in order to eliminate odors produced by microorganisms. Instead, it is preferably being used to prevent spoilage of the allergen neutralization composition in order to increase the shelf-life of the composition. Preferred levels of preservative are from about 0.0001% to about 0.5%, more preferably from about 0.0002% to about 0.2%, most preferably from about 0.0003% to about 0.1%, by weight of the usage composition.

The preservative can be any organic preservative material which will not cause damage to fabric appearance, e.g., discoloration, coloration, bleaching. Preferred water-soluble preservatives include organic sulfur compounds, halogenated compounds, cyclic organic nitrogen compounds, low molecular weight aldehydes, quaternary ammonium compounds, dehydroacetic acid, phenyl and phenolic compounds, and mixtures thereof.

Anti-Oxidant

The compositions of the present invention can optionally comprise anti-oxidants. The level of anti-oxidants can vary widely depending upon the end use of the composition. When present, the compositions will typically comprise from about 0.01% to about 10%, more typically from about 0.1% to about 5%, by weight, of anti-oxidants.

Preferred anti-oxidants herein are selected from the group consisting of D-isoascorbic acid, Dibutyl hydroxy toluene (BHT), dl-alpha-tocophenol, n-dodecyl gallate, styrenated phenol, 4, 4'-butylidene bis (6-ter-butyl-3-methylpheno), 4,4'-thio bis (6-tert-butyl-3-methylphenol), 1,1-bis (4-hydroxyphenyl)cyclohexane, 2,2,thio (diethyl bis 3,3,5-
 5 di-t-butyl-4-hydroxyphenyl) propionate, hexane-1,6-diamine, N, N'-bis (-2,2,6,6,-tetramethyl-4-diperidiny), and mixture thereof.

II. ARTICLE OF MANUFACTURE

The compositions of the present invention can also be used in an article of
 10 manufacture comprising said composition plus a spray dispenser. When the commercial embodiment of the article of manufacture is used, it is optional, but preferable, to include the preservative. Therefore, the most basic article of manufacture comprises a aluminum ion, a solvent, and a spray dispenser.

15 ***SPRAY DISPENSER***

The article of manufacture herein comprises a spray dispenser. The allergen neutralization composition is placed into a spray dispenser in order to be distributed onto fabrics or other surfaces. The spray dispenser is preferably any of the manually activated means for producing a spray of liquid droplets as is known in the art, e.g. trigger-type,
 20 pump-type, non-aerosol self-pressurized, and aerosol-type spray means. The spray dispenser herein does not normally include those that will substantially foam the allergen neutralization composition. It has been found that the performance is increased by providing smaller particle droplets. Desirably, the Sauter mean particle diameter is from about 10 μm to about 120 μm , more preferably, from about 20 μm to about 100 μm .

25 The spray dispenser can be an aerosol dispenser. An aerosol dispenser comprises a container which can be constructed of any of the conventional materials employed in fabricating aerosol containers. The dispenser must be capable of withstanding internal pressure in the range of from about 20 to about 110 p.s.i.g., more preferably from about 20 to about 70 p.s.i.g. One important requirement concerning the dispenser is that it be
 30 provided with a valve member which will permit the allergen neutralization composition contained in the dispenser to be dispensed in the form of a spray of very fine, or finely

divided, particles or droplets. The aerosol dispenser utilizes a pressurized sealed container from which the allergen neutralization composition is dispensed through a special actuator/valve assembly under pressure. The aerosol dispenser is pressurized by incorporating therein a gaseous component generally known as a propellant. Common aerosol propellants, e.g., gaseous hydrocarbons such as isobutane, and mixed halogenated hydrocarbons, which are not preferred. Halogenated hydrocarbon propellants such as chlorofluoro hydrocarbons have been alleged to contribute to environmental problems. Preferred propellants are compressed air, nitrogen, inert gases, carbon dioxide, etc. A more complete description of commercially available aerosol-spray dispensers appears in U.S. Pat. Nos.: 3,436,772, Stebbins, issued April 8, 1969; and 3,600,325, Kaufman et al., issued August 17, 1971; both of said references are incorporated herein by reference.

Preferably the spray dispenser can be a self-pressurized non-aerosol container having a convoluted liner and an elastomeric sleeve. Said self-pressurized dispenser comprises a liner/sleeve assembly containing a thin, flexible radially expandable convoluted plastic liner of from about 0.010 to about 0.020 inch thick, inside an essentially cylindrical elastomeric sleeve. The liner/sleeve is capable of holding a substantial quantity of odor-absorbing fluid product and of causing said product to be dispensed. A more complete description of self-pressurized spray dispensers can be found in U.S. Pat. Nos. 5,111,971, Winer, issued May 12, 1992, and 5,232,126, Winer, issued Aug. 3, 1993; both of said references are herein incorporated by reference. Another type of aerosol spray dispenser is one wherein a barrier separates the odor absorbing composition from the propellant (preferably compressed air or nitrogen), as disclosed in U.S. Pat. No. 4,260,110, issued April 7, 1981, and incorporated herein by reference. Such a dispenser is available from EP Spray Systems, East Hanover, New Jersey.

More preferably, the spray dispenser is a non-aerosol, manually activated, pump-spray dispenser. Said pump-spray dispenser comprises a container and a pump mechanism which securely screws or snaps onto the container. The container comprises a vessel for containing the aqueous odor-absorbing composition to be dispensed.

The pump mechanism comprises a pump chamber of substantially fixed volume, having an opening at the inner end thereof. Within the pump chamber is located a pump

stem having a piston on the end thereof disposed for reciprocal motion in the pump chamber. The pump stem has a passageway there through with a dispensing outlet at the outer end of the passageway and an axial inlet port located inwardly thereof.

The container and the pump mechanism can be constructed of any conventional material employed in fabricating pump-spray dispensers, including, but not limited to: polyethylene; polypropylene; polyethyleneterephthalate; blends of polyethylene, vinyl acetate, and rubber elastomer. A preferred container is made of clear, e.g., polyethylene terephthalate. Other materials can include stainless steel. A more complete disclosure of commercially available dispensing devices appears in: U.S. Pat. Nos.: 4,895,279, Schultz, issued January 23, 1990; 4,735,347, Schultz et al., issued April 5, 1988; and 4,274,560, Carter, issued June 23, 1981; all of said references are herein incorporated by reference.

Most preferably, the spray dispenser is a manually activated trigger-spray dispenser. Said trigger-spray dispenser comprises a container and a trigger both of which can be constructed of any of the conventional material employed in fabricating trigger-spray dispensers, including, but not limited to: polyethylene; polypropylene; polyacetal; polycarbonate; polyethyleneterephthalate; polyvinyl chloride; polystyrene; blends of polyethylene, vinyl acetate, and rubber elastomer. Other materials can include stainless steel and glass. A preferred container is made of clear, e.g. polyethylene terephthalate. The trigger-spray dispenser does not incorporate a propellant gas into the odor-absorbing composition, and preferably it does not include those that will foam the odor-absorbing composition. The trigger-spray dispenser herein is typically one which acts upon a discrete amount of the odor-absorbing composition itself, typically by means of a piston or a collapsing bellows that displaces the composition through a nozzle to create a spray of thin liquid. The trigger-spray dispenser typically comprises a pump chamber having either a piston or bellows which is movable through a limited stroke response to the trigger for varying the volume of said pump chamber. This pump chamber or bellows chamber collects and holds the product for dispensing. The trigger spray dispenser typically has an outlet check valve for blocking communication and flow of fluid through the nozzle and is responsive to the pressure inside the chamber. For the piston type trigger sprayers, as the trigger is compressed, it acts on the fluid in the chamber and the

spring, increasing the pressure on the fluid. For the bellows spray dispenser, as the bellows is compressed, the pressure increases on the fluid. The increase in fluid pressure in either trigger spray dispenser acts to open the top outlet check valve. The top valve allows the product to be forced through the swirl chamber and out the nozzle to form a discharge pattern. An adjustable nozzle cap can be used to vary the pattern of the fluid dispensed.

For the piston spray dispenser, as the trigger is released, the spring acts on the piston to return it to its original position. For the bellows spray dispenser, the bellows acts as the spring to return to its original position. This action causes a vacuum in the chamber. The responding fluid acts to close the outlet valve while opening the inlet valve drawing product up to the chamber from the reservoir.

A more complete disclosure of commercially available dispensing devices appears in U.S. Pat. Nos. 4,082,223, Nozawa, issued Apr. 4, 1978; 4,161, 288, McKinney, issued Jul. 17, 1985; 4,434,917, Saito et al., issued Mar. 6, 1984; and 4,819,835, Tasaki, issued Apr. 11, 1989; 5,303,867, Peterson, issued Apr. 19, 1994; all of said references are incorporated herein by reference.

A broad array of trigger sprayers or finger pump sprayers are suitable for use with the compositions of this invention. These are readily available from suppliers such as Calmar, Inc., City of Industry, California; CSI (Continental Sprayers, Inc.), St. Peters, Missouri; Berry Plastics Corp., Evansville, Indiana, a distributor of Guala[®] sprayers; or Seaquest Dispensing, Cary, Illinois.

The preferred trigger sprayers are the blue inserted Guala[®] sprayer, available from Berry Plastics Corp., or the Calmar TS800-1A[®], TS1300[®], and TS-800-2[®], available from Calmar Inc., because of the fine uniform spray characteristics, spray volume, and pattern size. More preferred are sprayers with precompression features and finer spray characteristics and even distribution, such as Yoshino sprayers from Japan. Any suitable bottle or container can be used with the trigger sprayer, the preferred bottle is a 17 fl-oz. bottle (about 500 ml) of good ergonomics similar in shape to the Cinch[®] bottle. It can be made of any materials such as high density polyethylene, polypropylene, polyvinyl chloride, polystyrene, polyethylene terephthalate, glass, or any

other material that forms bottles. Preferably, it is made of high density polyethylene or clear polyethylene terephthalate.

For smaller fluid ounce sizes (such as 1 to 8 ounces), a finger pump can be used with canister or cylindrical bottle. The preferred pump for this application is the
5 cylindrical Euromist II® from Sequest Dispensing. More preferred are those with precompression features.

III. METHOD OF USE

The present compositions can be used by distributing, e.g., by placing the allergen
10 neutralizing composition into a dispensing means, preferably a spray dispenser and spraying an effective amount onto the desired surface or article. An effective amount is defined herein as an amount to neutralize at least about 50%, preferably at least about 60%, more preferably at least about 80%, and most preferably at least about 90% of the allergens on the surface or article that is sprayed. The amount of allergen that is
15 neutralized can be measured by the Elisa test defined below. The delivery mechanism should be controlled such that a pool of liquid is not created on the article or surface and so that when dry there is no visual deposit readily discernible. Distribution can be achieved by using a spray device, a roller, a pad, a brush or the like.

The present invention encompasses the method of spraying an effective amount of
20 allergen neutralizing composition onto household surfaces. Preferably the household surfaces are selected from the group consisting of countertops, cabinets, walls, floors, bathroom surfaces and kitchen surfaces.

The present invention encompasses the method of spraying a mist of an effective amount of allergen neutralizing composition onto fabric and/or fabric articles. Preferably,
25 the fabric and/or fabric articles include, but are not limited to, clothes, curtains, drapes, upholstered furniture, carpeting, bed linens, bath linens, tablecloths, sleeping bags, tents, car interior, etc.

The present invention relates to the method of spraying a mist of an effective amount of allergen neutralizing composition onto cat litter, pet bedding and pet houses.

30

EXAMPLES

The following are non-limiting examples of allergen neutralization compositions according to the present invention, and standardized methods for determining the efficacy of the present compositions.

5

EXAMPLE I

Efficacy Determination Protocol, "ELISA"

The efficacy of an allergen neutralization composition can be determined by the ELISA protocol. Enzyme-linked immunosorbent assay ("ELISA") is a highly sensitive assay technique for detection and measurement of antigens or antibodies in solution. The assay uses enzyme-linked antigens or antibodies to amplify an antigen-antibody reaction. A single enzyme-linked antibody-antigen complex can convert orders of magnitude more of colorless substrate molecules into detectable colored products, thus considerably amplifying the original antigen-antibody reaction. The antigen or antibody is adsorbed onto the surface of the well of a microtiter plate, and all the relevant reactions take place in solution inside the well. While the following protocol will be easily understood by those skilled in the art, for a more detailed explanation please see Konishi, E. and Uehara, K. Enzyme-linked immunosorbent assay for quantifying antigens of *Dermatophagoides farinae* and *D. pteronyssinus* (Acari: Pyroglyphidae) in house dust samples, 1990, *Entomologist Society of America*, **27** (6), p. 993-998.

It is understood that those skilled in the art of allergen suppression will be aware of numerous variations to the protocol given below. For example, the monoclonal antibody may be substituted with a similar antibody, for example Der f 1 for Der f 2. But a standard, in this case water, is used and the results for the samples that contain active ingredients are normalized against the standard and the results reported as percentage of allergen remaining. That is, the amount of allergen that is not neutralized. Thus, the allergen neutralization results for similar, but not identical antibodies should be substantially the same when normalized to the standard. Both Der f 1 and Der f 2 were tested for various compositions. Der f 1 was chosen as the standard for the present Efficacy Determination Protocol. The results for the Der f 1 tests are presented in Table I A and the result for Der f 2 are given in Table I B.

Sample Preparation

At least two samples are prepared. One sample contains only distilled water and samples of one or more allergen neutralization compositions containing the allergen neutralization active, for example $\text{Al}_2(\text{SO}_4)_3$, tannin, etc. The samples are all treated according to the same protocol, and the distilled water sample is used as the control. All

5 samples are prepared as follows:

1) Add 1.0 ml of 20ug/ml *Dermatophagoides farinae* mite extract to 0.8 ml of the sample composition (either the allergen neutralization composition or water for the control). Mix well and let sit for 1 hour at room temp.

2) Add 2.2 ml of 20% skim milk in Phosphate Buffer Saline (PBS).

10 3) Mix well by vortexing and centrifuge at 12000 rpm (approx. 17000xg) for 1 hour.

4) The supernatant is used for the ELISA protocol.

ELISA Protocol

Each well of a microplate is coated at 4°C overnight with 100 µl of Der f 2 monoclonal antibody (clone 15E11, from Asahi Breweries., AB-A-4) at a protein

15 concentration of 2 µg per ml of Phosphate Buffer Saline (PBS), pH 7.4 containing 0.1% sodium azide. The monoclonal antibody is discarded and the plate is incubated with 100 µl of 1% BSA PBS containing 0.1% sodium azide for 1 hour. The plate is washed 3 times with PBS containing 0.05% Tween 20 (PBS-T). 100 µl of an allergen sample is added and incubated for 1 hour at 37°C.

20 Use 3x dilutions of a reference *Dermatophagoides farinae* crude extract (commercially available from LSL) to make the standard curve. The curve is made using 6.9 nanogram-mite extract equivalent/ml to 5 microgram-mite extract equivalent/ml. Wash plate with PBS-T for 3 times. 100 µl of Horse Radish Peroxidase (HRP) conjugated anti Der f 2 antibody (clone 13A4) is added at 40 ng/ml and the plate is

25 incubated at 37°C for 1 hour. The plate is then washed with PBS-T 3 times and then washed with water 3 times. The wells are incubated with 100 µl of o-phenylene diamine at 2.0 mg/ml of 0.1M phosphate buffer (pH 6.2) containing 0.03% H_2O_2 . The enzyme reaction is terminated by adding 50 µl of 2 M H_2SO_4 .

The absorbance of the sample is read at 490 nm with a cell length of 1 cm. The

30 absorbance reading is directly proportional to the quantity of Der f 2 bound and the values

calculated from the respective standard curve (Optical Density, or absorbance range is 0.001 to 3.6). The absorbance reading for the control (water) is considered as 0% allergen neutralization (100% of the Der f 2 remaining) and an absorbance reading of 0 is considered 100% allergen neutralization (0% of the Der f 2 remaining). The absorbance of the active containing sample(s) is then normalized based on these two end points.

As stated above, the allergen neutralization compositions of the present invention neutralize at least about 50%, preferably at least about 60%, more preferably at least about 80% and most preferably at least about 90% of allergen containing proteins as measured by the ELISA test protocol for Der f 1. The performance data against Der f 2 is much lower (as would be expected by those skilled in the art) but the concentration of aluminum ion is relatively low. Thus, the data in Table I B confirms the relative effectiveness of aluminum ion with various anions, and by increasing the concentration of aluminum ions the effectiveness against Der f 2 can be increased.

Table I illustrates that the "effective amount" of the aluminum ion will vary depending on its associated anion. As discussed above, aluminum chlorohydrate has relatively poor performance at deactivating dust mite allergens. Those skilled in the art will be able to determine the effective amount for different aluminum ions with various anions without undue experimentation using the teachings and Examples herein.

TABLE I A
Versus Der f 1

Active Compound	Anion	Wt. % of Ion*	pH	% of Allergen Neutralized
Control	-	-	3.5	0
Al(OH)Cl ₂	Chlorohydrate	0.26	3.5	59
Al ₂ (SO ₄) ₃	Sulfate	0.26	3.5	66
AlCl ₃	Chloride	0.26	3.5	85
Al(NO ₃) ₃	Nitrate	0.26	3.5	93
AlK(SO ₄) ₂	Potassium Sulfate	0.26	3.5	65
Al Lactate	Lactate	0.26	3.5	30

*% by weight of the active ion in the allergen neutralization composition before the Sample Preparation.

TABLE I B

Versus Der f 2

Active Compound	Anion	Wt. % of Ion*	pH	% of Allergen Neutralized
Control	-	-	3.5	0
Al(OH)Cl ₂	Chlorohydrate	0.26	3.5	3
Al ₂ (SO ₄) ₃	Sulfate	0.26	3.5	6
AlCl ₃	Chloride	0.26	3.5	17
Al(NO ₃) ₃	Nitrate	0.26	3.5	50
AlK(SO ₄) ₂	Potassium Sulfate	0.26	3.5	23
Al Lactate	Lactate	0.26	3.5	17

*% by weight of the active ion in the allergen neutralization composition before the Sample Preparation.

5

EXAMPLE II

Tables II A, B and C contain sample compositions according to the present invention.

TABLE II A

Material	1 Wt. %	2 Wt. %	3 Wt. %	4 Wt. %	5 Wt. %
Al ₂ (SO ₄) ₃	3.0	0	0	0.3	0
AlCl ₃ 6H ₂ O	0	0	2.0	0	0
Al(NO ₃) ₃	0	3.0	0	0	0.3
Al 3+ ion	0.3	0.2	0.2	0.03	0.02
Polyquaternium-5	0.1	0	0.25	0.05	0.05
Buffer*	0.05	0.2	0.15	0.1	0.2
Diethylene Glycol**	0.4	0.5	0.8	0.2	0
Wetting agent***	0.05	0.1	0.5	0.1	0.1
Ethanol	3.0	5.0	10.0	3.0	0
Water	Balance	Balance	Balance	Balance	Balance

10

TABLE II B

Material	6 Wt. %	7 Wt. %	8 Wt. %	9 Wt. %	10 Wt. %
Al ₂ (SO ₄) ₃	0	2.0	0.3	3.0	1.5
AlCl ₃ 6H ₂ O	0.2	0	0.2	0	2.0
Al(NO ₃) ₃	0	2.0	0.3	0	1.0
Al 3+ ion	0.02	0.34	0.07	0.03	0.5
Methyl Cellulose	0	0.4	0.5	0.1	0.5

Buffer*	0.05	0.2	0.15	0.1	0.2
Diethylene Glycol**	0.4	0.5	0.8	0.2	0
Wetting agent***	0.05	0.1	0.5	0.1	0.1
NaCl ₂	0	3.0	0	0	3.0
Ethanol	3.0	5.0	10.0	3.0	0
Water	Balance	Balance	Balance	Balance	Balance

TABLE II C

Material	1 Wt. %	2 Wt. %	3 Wt. %	4 Wt. %	5 Wt. %
Al ₂ (SO ₄) ₃	3.0	0	0	0.3	0
AlCl ₃ 6H ₂ O	0	0	2.0	0	0
Al(NO ₃) ₃	0	3.0	0	0	0.3
Al 3+ ion	0.3	0.3	0.2	0.03	0.03
Tannin	0.05	0.5	0.25	0	0
Buffer*	0.05	0.2	0.15	0.1	0.2
Diethylene Glycol**	0.4	0.5	0.8	0.2	0
Wetting agent***	0.05	0.1	0.5	0.1	0.1
Ethanol	3.0	5.0	10.0	3.0	0
Water	Balance	Balance	Balance	Balance	Balance

*Buffer is HCl, Citric acid, or mixtures of each; or NaOH

5 **Diethylene Glycol is used to neutralize the odor associated with ethanol

***Wetting agent is Silwet L-7600 or Coco K3 (a cationic surfactant)

10